

What is claimed is:

1. A method of calculating a result  $E$  of an exponentiation  $B^d$ ,  $B$  being a base and  $d$  being an exponent, wherein the  
5 exponent can be described by a binary number from a plurality of bits, comprising the following steps:

initializing a first auxiliary quantity  $X$  to a value of 1;

10 initializing a second auxiliary quantity  $Y$  to the base  $B$ ;

sequentially processing the bits of the exponent by:

15 updating the first auxiliary quantity  $X$  by  $X^2$  or by a value derived from  $X^2$  and updating the second auxiliary quantity  $Y$  by  $X*Y$  or by a value derived from  $X*Y$ , if a bit of the exponent equals 0, or

20 updating the first auxiliary quantity  $X$  by  $X*Y$  or by a value derived from  $X*Y$  and updating the second auxiliary quantity  $Y$  by  $Y^2$  or by a value derived from  $Y^2$ , if a bit of the exponent equals 1; and

after sequentially processing all the bits of the exponent,  
25 using the value of the first auxiliary quantity  $X$  as the result of the exponentiation.

2. The method according to claim 1, wherein in the step of sequentially processing is started from the most significant  
30 bit of the exponent.

3. The method according to claim 1,

wherein the exponentiation is a modular exponentiation  $B^d \bmod N$ ,  $N$  being the module, and  
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wherein the value derived from  $X^2$ ,  $XY$  or  $Y^2$  is generated by a modular reduction with the module  $N$  of  $X^2$ ,  $XY$  and  $Y^2$ , respectively.

5 4. The method according to claim 1,

wherein in the step of updating, if the bit of the exponent equals 1, the value  $X^2$  and the value  $X*Y$  are calculated parallel to each other.

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5. The method according to claim 1,

wherein in the step of updating, if the bit equals 0, the value  $X*Y$  and the value  $Y^2$  are calculated parallel to each other.

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6. The method according to claim 3,

wherein the modular exponentiation is used in an RSA decryption and/or an RSA encryption.

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7. The method according to claim 3,

wherein the exponent  $d$ , the base  $B$  and/or the module  $N$  are integers.

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8. A device for calculating a result  $E$  of an exponentiation  $B^d$ ,  $B$  being a base and  $d$  being an exponent, wherein the exponent can be described by a binary number from a plurality of bits, comprising:

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an initializer for initializing a first auxiliary quantity  $X$  to a value of 1 and a second auxiliary quantity  $Y$  to the base  $B$ ; and

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a processor for sequentially processing the bits of the exponent by:

updating the first auxiliary quantity  $X$  by  $X^2$  or by a value derived from  $X^2$  and updating the second auxiliary quantity  $Y$  by  $X*Y$  or by a value derived from  $X*Y$ , if a bit of the exponent equals 0, or

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updating the first auxiliary quantity  $X$  by  $X*Y$  or by a value derived from  $X*Y$  and updating the second auxiliary quantity  $Y$  by  $Y^2$  or by a value derived from  $Y^2$ , if a bit of the exponent equals 1;

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wherein the processor is operative to use the value of the first auxiliary quantity  $X$  as the result of the exponentiation after having sequentially processed all the bits of the exponent.

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9. The device according to claim 8,

wherein the processor for sequentially processing comprises a first calculating unit and a second calculating unit, the first calculating unit and the second calculating unit being arranged to operate parallel to each other, and

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wherein the first calculating unit is arranged to calculate  $X^2$  if the bit of the exponent equals 0 or to calculate  $X*Y$  if the bit of the exponent equals 1, and

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wherein the second calculating unit is arranged to calculate  $X*Y$  if the bit equals 0 and to calculate  $Y^2$  if the bit equals 1.